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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/672,395	09/26/2003	Chen-Hua Yu	TS02-1308	9171

7590 05/04/2004  
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EXAMINER

NGUYEN, THANH T

ART UNIT PAPER NUMBER

2813

DATE MAILED: 05/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/672,395

Applicant(s)

YU ET AL.

Examiner

Thanh T. Nguyen

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 26 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 18-33 is/are allowed.
- 6) ☐ Claim(s) 1,3-13 and 15-17 is/are rejected.
- 7) ☐ Claim(s) 2 and 14 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 12/24/03.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Information Disclosure Statement***

The information disclosure statement filed 12/24/03 has been considered.

### ***Oath/Declaration***

Oath/Declaration filed on 9/26/03 has been considered.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-13, 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chung (U.S. Patent No. 5,666,007) in view of Brown et al. (U.S. Patent No. 6,187,670) and further in view of Nishizawa (U.S. Patent No. 6,613,686).

Referring to figures, teaches a method of fabricating an integrated circuit on a substrate, comprising:

Art Unit: 2813

a) providing a semiconductor substrate (see claim 10) with a dielectric layer (214) formed thereon;

b) forming an electroconductive layer (2406/2408/2410/2412) on the dielectric layer (214);

c) forming a pattern comprised of an opening (218/220) in the electroconductive layer (2406/2408/2410/2412) that extends through the dielectric layer (214);

d) depositing a diffusion barrier layer (2402/2404) on the electroconductive layer (2406/2408/2410/2412) and within the opening (218/220).

Forming a metal layer (2448, W) in the opening (218/220).

Regarding to claims 5-6, the material of electroconductive layer (see col. 9, lines 1-10). It is noted that the same material would provide the same function for example electroductive material is made of TiN/AlCu/Ti which is same material as the present invention. Therefore, it would function as a hard mask and stop layer.

Regarding to claim 8, patterning a photoresist film (see figure 8, col. 8, lines 4-21).

Regarding to claim 12, see col. 6, lines 36-51

However, Chung does not teach depositing a metal seed layer on the diffusion layer, and removing the metal seed above the electroconductive layer by a first planarization process, etching stop layer, polishing rate, and the thickness of the layer.

Referring to figures 1a-4, Brown et al. teaches forming a metal seed layer (224/226, Cu or W) in the opening (106/118), forming a metal layer (228, Cu or W) by electroplating process (called electrochemical deposition)(see col. 6, lines 31-37), removing the metal seed layer (224/226) by planarization step (called Chemical mechanical polishing, see col. 5, lines 30-34).

Absent a showing of unexpected result, a change in sequence involves routine optimization of process of prior art and would have been obvious to one skilled in the art at the time the invention was made. A change in sequence/reversal of process steps is obvious under 35 USC 103 (ex parte Rubin, 128 USPQ 440 (Bd. App. 1959)). See also in re Burhans, 154 F.2d 690, 69 USPQ 330 (CCPA).

Regarding to claim 10, an etch stop layer (114) formed on the conductive layer (101/2001).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would forming an etching stop layer on the conductive layer and depositing a metal seed layer on the diffusion layer, and removing the metal seed above the electroconductive layer by a first planarization process in process of Chung as taught by Brown because the stop layer would prevent over etch, removing the metal to provide a planar surface.

Nishizawa teaches a method of forming an etching stop layer (5), forming a dielectric layer BPSG (see col. 8, lines 21-34, meeting claim 3) with the thickness of 8000 Angstroms (see col. 5, lines 62-67, noted that 800nm=8000 angstroms), forming an opening (8, see figure b-c) by etching the dielectric layer and etch stop layer to by using plasma etching (see col. 7, lines 56-67, meeting claim 11).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form a dielectric layer by using BPSG and etching the opening by using plasma etching in process of Chung as taught by Nishizawa because the process would prevent over etch into the conductive layer, and BPSG is easy to reflow to provide a planar surface.

Art Unit: 2813

Regarding to claims 4, 7, 12-13 it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made to optimize the width of the opening and the thickness of the electroconductive layer, since it has been held that where the general conditions of a claim are disclosed in the prior art (i.e.-the opening, and electroconductive layer), discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233 (CCPA 1955).

The specification contains no disclosure of either the critical nature of the claimed arrangement (i.e.- width of the opening, the polishing rate and the thickness of the layer) or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen limitations or upon another variable recited in a claim, the applicant must show that the chosen limitations are critical. In re Woodruff, 919 F.2d 1575, 1578 (FED. Cir. 1990).

Therefore it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form the opening with the determined width and the thickness of the electroconductive layer in process of Chung in order to optimize the process.

#### ***Allowable Subject Matter***

Claims 2, 14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 18-33 are allowed.

#### **Reason for allowance:**

None of the prior art alone or in combination teaches or suggests the particular subset of

Art Unit: 2813

the process steps in performing a second planarization process so that the metal layer becomes coplanar with the dielectric layer.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See **MPEP 203.08**).



Thanh Nguyen  
Patent Examiner  
Patent Examining Group 2800

TTN